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(58) Field of search
F4S

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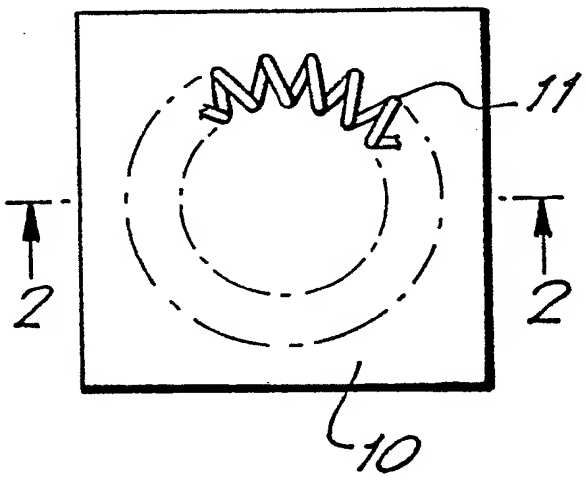
(54) Heat transfer devices

(57) A heat transfer device, particularly for cooling electronic devices, comprises a plurality of spaced loops of heat-conductive material carried by a body to be cooled, the arrangement being such that ambient fluid can pass between and through the loops to effect desired cooling of said body without fluid flow through said heat-conductive material. The heat-conductive material may for example be wire in the form of a coil providing said loops or the body and loops may be pressed out in one piece from sheet metal. The arrangement is particularly useful in connection with leadless chip carriers. The device may be releasably secured by snap action resilient means.

FIG.1.



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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

FIG.1.

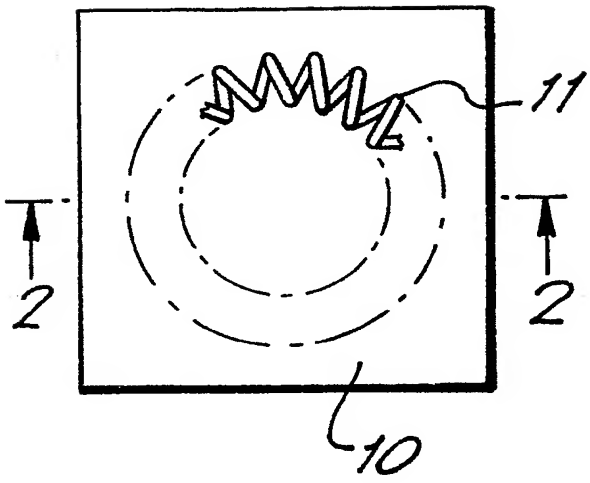
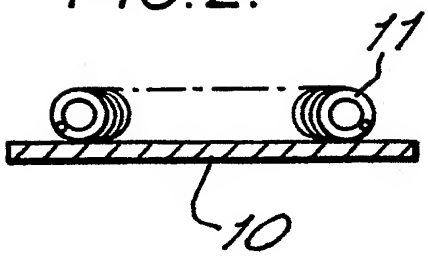


FIG.2.



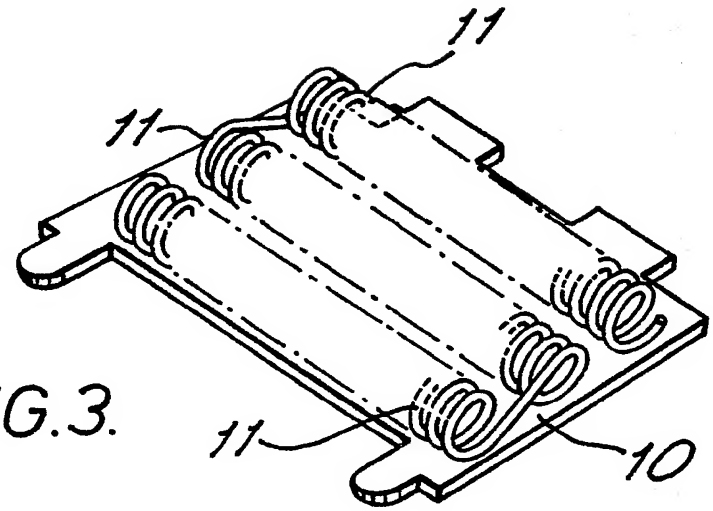


FIG.3.

FIG.4.

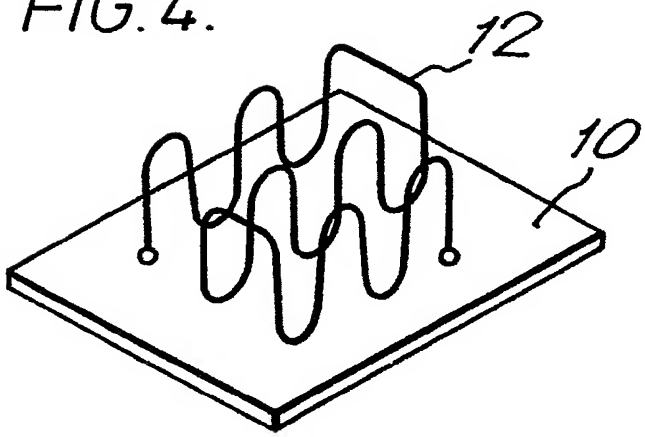
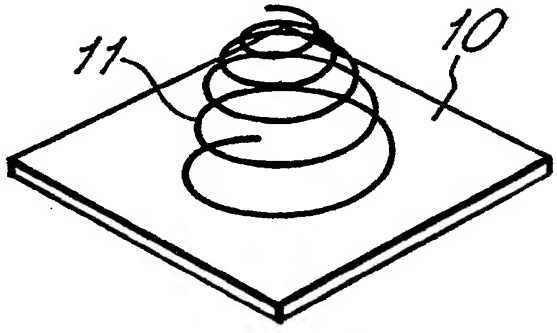


FIG.5.



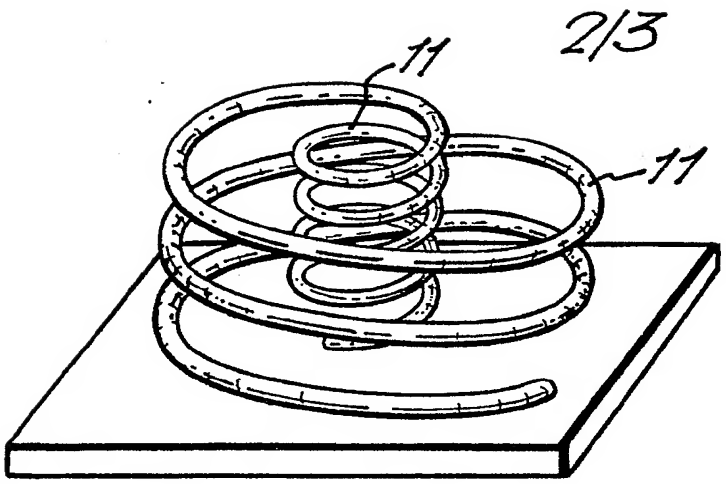


FIG.6.

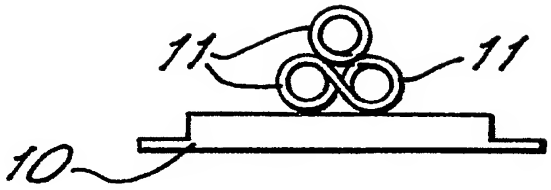


FIG.7.

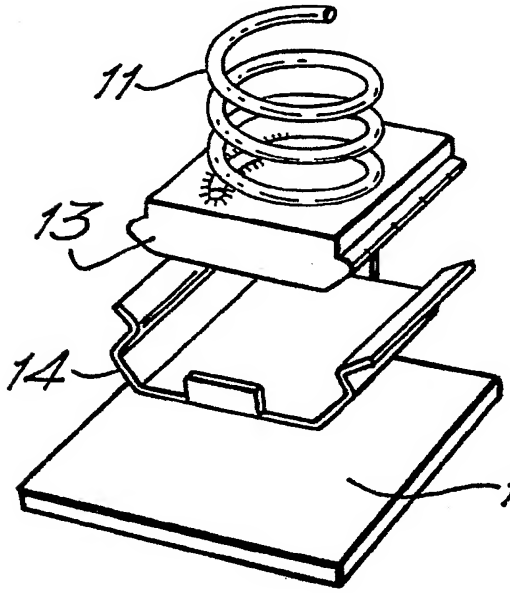


FIG.8.

FIG.9.

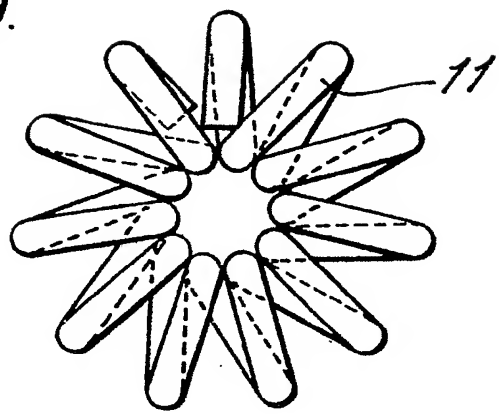
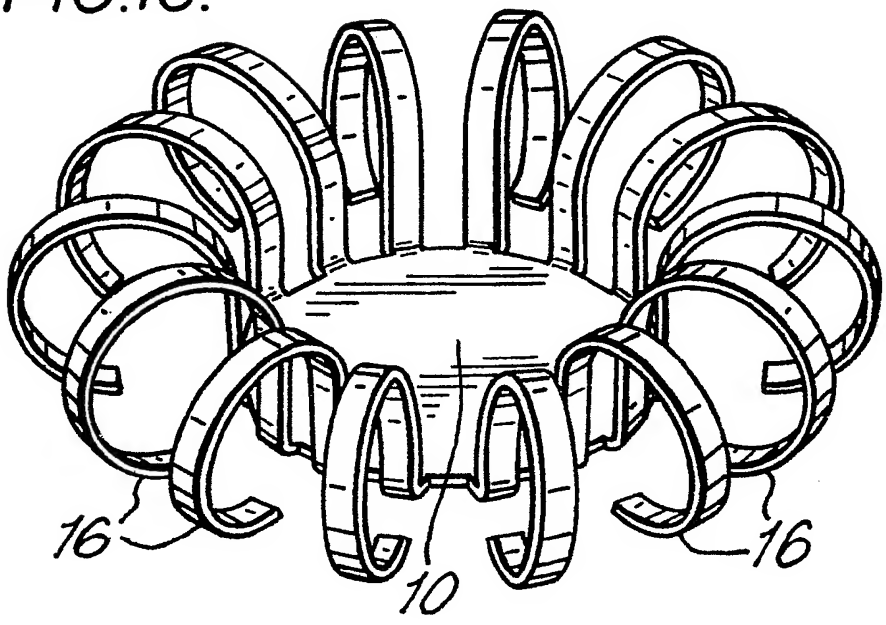


FIG.10.



SPECIFICATION

Heat transfer devices

This invention is concerned with heat transfer devices.

Heat transfer devices are known having fins or vanes for transferring heat from a body to be cooled to an ambient fluid medium. For example, it is known to provide heat sinks for cooling electronic devices with vanes or fins to transfer heat to the ambient air.

It is an object of the present invention to provide an efficient, simple and readily manufactured device for heat transfer.

According to the invention, a heat transfer device comprises a plurality of spaced loops of heat conductive material carried by a body to be cooled, the arrangement being such that ambient fluid can pass between and through the loops to effect desired cooling of said body without fluid flow through said heat-conductive material.

Thus, while the heat-conductive material may be hollow or tubular, the arrangement is such that fluid does not flow through it. Normally, however, the heat conductive material will be of solid cross-section, e.g. it may be aluminium or other metal wire.

Accordingly, in a preferred form of the invention, a heat transfer device comprises a plurality of spaced loops of wire carried by and projecting from a body to be cooled.

Preferably, the heat-conductive material is in the form of a coil providing said loops. One or both ends of the coil may be connected to said body. Where one end is connected to the body, the coil may suitably be in the form of a coil spring of cylindrical or conical shape. Alternatively, the coil may be connected sideways (preferably at each loop or turn) to the body.

In that case, the coil may have a straight centre line or a curved (e.g. circular) centre line. For example, a plurality of parallel, straight coils may be provided. However, it has been found that a particularly efficient configuration is a coil in the form of a loop (e.g. a circular or toroidal coil) connected sideways to the body. Normally, an air gap will be left between the ends of the material forming the loop-form coil.

In another form of the invention, the body and loops are formed in one piece from sheet metal, the loops preferably being disposed around the edge of the body.

The loops are preferably circular but may be of other shapes, e.g. elliptical or generally rectangular.

An important application of the present invention is to heat sinks for cooling electronic devices. In particular, the invention is useful in connection with electronic devices of the kind known as leadless chip carriers, in which case the loops of the present invention may be connected to the chip carrier or to a plate for bearing down on the chip carrier. Some chip carrier sockets have a lid which bears down on to the chip and acts as a heat sink. In this case, the loops of the present invention may be connected to the lid.

Other chip carrier sockets have a lid with a window.

In this case, the loops of the present invention may be carried by a heat-conductive plate, constituting the aforesaid body, adapted to fit under the lid so as to be pressed down on the chip carrier while the loops project through the window. Alternatively, the loops may be secured, e.g. by adhesive, directly to the chip carrier.

The body which carries the loops may be arranged to be releasably secured by snap action resilient means to a part adapted to be secured to the chip carrier or a lid or plate thereover. Thus, the invention further provides means for mounting a heat sink on a heat-emitting electronic device comprising a first part arranged to be secured, e.g. by adhesive, to the electronic device and a second part which acts as a heat sink and which is arranged to be releasably secured to the first part by snap action resilient means.

The following is a description, by way of example, of various embodiments of the invention, reference being made to the accompanying diagrammatic drawings, in which:

Figure 1 is a plan view of a lid or plate for a leadless chip carrier having a heat transfer device in accordance with the invention,

Figure 2 is a cross-section on line 2-2 of Fig. 1,

Figure 3 is a perspective view of a second embodiment,

Figure 4 is a perspective view of a third embodiment,

Figure 5 is a perspective view of a fourth embodiment,

Figure 6 is a side view of a fifth embodiment,

Figure 7 is an end view of a sixth embodiment,

Figure 8 is a perspective view of a seventh embodiment,

Figure 9 is a plan view of a coil in a variation of the embodiment of Figs. 1 and 2, and

Figure 10 is a perspective view of a further embodiment.

The same reference numerals are used for similar parts in the different Figures of the drawings. In Figs. 1, 2, 3, 5 and 6 a body 10 in the form of a generally rectangular lid or plate (e.g. of aluminium) for pressing down in flat face to face relationship on to a leadless chip carrier in a socket carries a helical coil or coils 11 of wire (e.g. of aluminium) secured, e.g. by soldering, in heat-conducting relationship therewith. The wire is of solid cross section (i.e. it is non-tubular). Normally, it will be of circular cross-section but other cross sections may be used. In all of the embodiments, the loops or turns of each coil are spaced apart to allow for free passage of air between and through the loops. The lid or plate 10 is shown simply as of rectangular shape except in Fig. 3, but will be formed as necessary to fit particular chip carrier sockets, one suitable form being shown in Fig. 3.

Figs. 1 and 2 show a preferred embodiment in which a circular or toroidal coil 11 of helical form is secured, e.g. by soldering, sideways to the plate

10, each turn of the coil being thus secured in heat-conducting relationship to the plate. Fig. 3 shows three straight parallel coils 11 secured sideways by each turn to the plate 10. The coils are shown as connected but separate coils may be provided. Fig. 4 shows an arrangement in which a wire 12 bent into a series of upstanding U-shaped loops is used instead of a coil, the base of each U being secured to the plate 10. Fig. 5 shows an embodiment in which the coil 11 is in the shape of a conical spring secured at its lower end to the plate 10. Fig. 6 shows an embodiment having two upright coils 11 disposed coaxially one within the other and radially spaced apart. Both coils are constructed from the same continuous wire, the transition from coil to coil occurring at a position distant from the plate 10 and both ends of the wire being secured to the plate. Fig. 7 shows an embodiment with one coil superposed sideways on and thermally connected to two other coils connected sideways to the plate. In the embodiment of Fig. 8, the coil 11 is of upright helical shape and attached at its lower end to a heat sink 13 which has opposite sides formed to be releasably secured by snap action in a resilient clip 14 which may be secured, e.g. by adhesive to a lid for a chip carrier 15 or directly to a chip carrier. The clip 14 biases the heat sink 13 into close face to face contact therewith to ensure good thermal contact. Fig. 9 shows an especially preferred form of circular or toroidal coil for use in the embodiment of Fig. 1 and 2. In the embodiment of Fig. 9,$,inner portions of turns of the coil touch each other at the central part of the formation while outer portions of the turns are spaced apart.

In the embodiments shown in Figs. 1 to 9, wire is used to form the loops. However, the loops are of course not necessarily made by bending wire. They may be made by other means, e.g. by press forming from sheet material. Fig. 10 shows an embodiment in which the body 10 and loops 16 are formed in one piece by pressing out from sheet metal. The body is circular and the loops, which are disposed around its edge, are of circular configuration, thus providing a form of toroid.

The use of loops as hereinbefore described provides very effective transfer of heat to the ambient air, because of the large surface area for a given volume of the loop material. Also, where forced air cooling is employed, the loops cause turbulence in the air flow which enhances the cooling effect.

CLAIMS

1. A heat transfer device comprising a plurality of spaced loops of heat-conductive material carried by a body to be cooled, the arrangement being such that ambient fluid can pass between and through the loops to effect desired cooling of said body without fluid flow through said heat-conductive material.

2. A heat transfer device according to claim 1 wherein the heat-conductive material is of solid cross-section.

3. A heat transfer device comprising a plurality of spaced loops of wire carried by and projecting from a body to be cooled.

4. A heat transfer device according to any preceding claim wherein the heat-conductive material is in the form of a coil providing said loops.

5. A heat transfer device according to claim 4 wherein one or both ends of the coil is or are connected to said body.

6. A heat transfer device according to claim 4 wherein one end of the coil is connected to the body and the coil is in the form of a coil spring of cylindrical or conical shape.

7. A heat transfer device according to claim 4 wherein the coil is connected sideways to the body.

8. A heat transfer device according to claim 7 wherein the coil is connected at each loop to the body.

9. A heat transfer device according to claim 7 or 8 wherein the coil has a straight centre line.

10. A heat transfer device according to claim 9 wherein a plurality of parallel, straight coils are provided.

11. A heat transfer device according to claim 7 or 8 wherein the coil has a curved centre line.

12. A heat transfer device according to claim 10 wherein the coil has a circular centre line.

13. A heat transfer device according to claim 11 or 12 wherein an air gap is left between the ends of the material forming the coil.

14. A heat transfer device according to claim 11, 12 or 13 wherein portions of loops of the coil on the inside of the curve touch each other while other portions of loops of the coil are spaced apart.

15. A heat transfer device according to claim 1 or 2 wherein the body and loops are formed in one piece from sheet metal.

16. A heat transfer device according to claim 15 wherein the loops are disposed around the edge of the body.

17. A heat transfer device according to any preceding claim wherein the loops are circular.

18. A heat sink for cooling an electronic device, said heat sink comprising a heat transfer device according to any preceding claim.

19. A heat transfer device according to any of claims 1 to 17 wherein said body comprises a leadless chip carrier, the loops being connected to the chip carrier.

20. A heat transfer device according to any of claims 1 to 17 wherein said body comprises a plate adapted to bear down on a chipless lead carrier, the loops being connected to the plate.

21. A leadless chip carrier socket comprising a heat transfer device according to any of claims 1 to 17.

22. A leadless chip carrier socket according to claim 21 having a lid for bearing down on to a chip in the socket, which lid acts as a heat sink and provides said body, the loops being connected to the lid.

23. A leadless chip carrier socket according to claim 21 having a lid with a window, said loops being carried by a heat-conductive plate, constituting said body, adapted to fit under the lid so as to

be pressed down on a chip carrier in the socket while the loops project through the window.

24. A leadless chip carrier socket according to claim 21 having a lid with a window and containing a chip carrier, said loops being secured directly to the chip carrier and projecting through the window.

25. A leadless chip carrier socket according to claim 21 wherein said body is arranged to be releasably secured by snap action resilient means to a part adapted to be secured to a chip carrier in the socket or a lid or plate thereover.

26. Means for mounting a heat sink on a heat emitting electronic device comprising a first part arranged to be secured to the electronic device and a second part constituting a body of a device according to any of claims 1 to 17, which second part acts as a heat sink and is arranged to be releasably secured to the first part by snap action resilient means.

27. A heat transfer device substantially as hereinbefore described with reference to the accompanying drawings.

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